In the Specification

Please amend the paragraphs in applicants' specification as indicated below:

[0031] Fig. 5(g) is a drawing showing a layer of the viscoelastic material 551 applied over the hinge 520 between the frame 552 and the adjoining support structure ~~552~~ [[553]]. This material is applied to fine tune the device performance after its fabrication by providing means of adjusting the damping while monitoring the device characteristics. The viscoelastic sheet has an adhesive coating on one side and the appropriately sized pieces are applied over the hinge area.

[0036] Another advantageously constructed embodiment is depicted in Fig. 7(a). This embodiment meets the challenge of packing the mirror 707, two sets of hinges 704 and 706, and frame 708 into as small an area as possible, so that optical components can be smaller and the overall dimensions of the cross connect switching system can be reduced. Fig. 7(b) shows a layer of the reflector assembly 701, which is formed just underneath the mirror/frame/hinge structure depicted in Fig. 7(a). Fig. 7(b) depicts the drive elements 707′, 707″, 708′ and 708″. As discussed above with respect to the embodiment of Fig. 6, the drive elements 707′, 707″ interact with the mirror 707 to provide deflection about a first axis. And the drive elements 708′, 708″ interact with the frame 708 to provide deflection about a second axis. The fabrication of such structures will be discussed in some detail hereinbelow.

[0037] With continued reference to Fig. 7(a), by packing more optical components on a given reflector array, smaller arrays may be constructed. Smaller reflector arrays allow a larger number of devices to be built on a given wafer, thus reducing the cost of these reflector arrays and the deflection angles required for switching. Furthermore, smaller structures have higher resonance frequencies, which improve switching and addressing times for the reflector array. Also, smaller reflector arrays enable shorter optical paths within switching devices. Due to the shorter optical paths possible with such embodiments, lower resolution

position sensing systems can be used, thereby reducing cost. The depicted pairs of serpentine hinges 704, 706 each have two windings. In order to achieve more compact serpentine hinges, portions of the windings are folded into a rectangular conformation, with the arms of each winding being fabricated to include proximal folds that are oriented such that they are parallel to the axis of rotation. An embodiment of such a radial serpentine hinge 04 is depicted in Fig. 7(c). The hinge 704 permits rotation (shown by the arrow) of the mirror 707 about axis of rotation. In the previous embodiment, the arms of each winding extend in a direction transverse to the axis of rotation. In the depicted embodiment, the arms 710, 711, 712, 713 of each winding are formed such that a portion of the arms (also referred to as the folded portion) extends approximately parallel to the axis of rotation. In the depicted embodiment, the inner folded arms (e.g., 712 and 713) are shorter than the outer folded arms (e.g. 710 and 711). In other embodiments having more windings, the arms are progressively longer and longer, the further the folded arms are from the axis of rotation x. One objective of "folding" the windings is to maintain the length of the hinge in a more compact space. Another way of describing the pairs of radial serpentine hinges 704, 706 is to say that the windings of the hinges have parallel arms. This means that the arms of the hinges extend in a direction substantially parallel to the axis of rotation. This is in contrast to the arms of an embodiment like that depicted in Fig. 5(a) where the arms can be said to be transverse to the axis of rotation.

[0040] Fig. 9(a) illustrates another preferred hinge embodiment. The depicted hinge 900 is a variable spring constant serpentine hinge. Such a variable spring constant serpentine hinge causes vibrational damping in the hinge. In some embodiments the implementation of such damping means is highly desirable. The depicted hinge 900 includes four windings. The hinge 900 begins with the longest arms on the winding at one end of the hinge 900 and the shortest arms at the other end of the hinge 900. The arms of each successive winding are progressively shorter than that of the previous winding. Thus, winding 922 is shorter than winding 921. In like manner, winding 923 is shorter than winding 922 and winding 924 is shorter than winding 923. Such

~~variablespring~~ variable spring constant serpentine hinges 900 improve the resonant and vibrational behavior of the optical elements suspended by the hinges. As with other hinges discussed herein, the number of winding is variable and determined by the designer prior to fabrication. The variable spring constant serpentine hinges 900 can be applied to any of the embodiments discussed herein. Such hinges have particular utility when applied to embodiments like that depicted in Fig. 9(b).

[0043] The embodiment 1000 includes a first frame 1010 which connected to the substrate 1065 by a pair of first serpentine frame hinges 1071 which allows the first frame 1010 to rotate about a first axis defined by the first serpentine frame hinges 1071. The first frame 1010 is constructed having an inside periphery 1100 and an outside periphery 1100'. The first serpentine frame hinges 1071 connect the outside periphery 1100' of the first frame 1010 to the substrate 1065. Positioned inside the first frame 1010 is a second frame 1008. The second frame 1008 includes an inside periphery 1080 and an outside periphery 1080'. The second frame 1008 is suspended and supported by a pair of first straight hinges 1081 that allow the second frame 1008 to rotate about an axis substantially parallel to the first axis defined by the pair of first serpentine frame hinges 1071. Positioned inside the second frame 1008 is a third frame 1009. The third frame 1009 also includes an inside periphery 1090 and an outside periphery 1090'. The third frame 1009 is suspended and supported by a pair of second serpentine frame hinges 1072 which connects the outside periphery 1090' of the third frame 1009 to the inside periphery 1080 for the second frame 1008. The pair of second serpentine frame hinges 1072 allows the third frame 1009 to rotate about a second axis defined by the pair of second serpentine frame hinges 1072. The second axis is typically transverse to the first axis. In a preferred embodiment the second axis is at a substantially right angle to the first axis. Positioned inside the third frame 1009 is a mirror 1007. The mirror 1007 includes an outside periphery 1070. The mirror 1007 is suspended and supported by a pair of second straight hinges 1082 that allows the mirror 1007 to rotate about an axis substantially parallel to the second axis defined by the pair of second serpentine frame hinges 1072.